EXHIBIT K

CHAPTER VII

DAMAGES

A. Introduction

Conducting a scientific experiment that will yield reliable results requires patience and attention to detail. Failing to follow the proper technique or employing inappropriate assumptions could render the results of the experiment worthless. An econometric damages study is just such a scientific experiment, with the risk from not following proper procedures that awards that may be too high or too low by millions, or even hundreds of millions, of dollars.

An econometric experiment must incorporate a number of fundamental elements for the practitioner to arrive at a valid conclusion. These elements relate to the design of the experiment, the structure of the economic model, the data and econometric techniques used to estimate the model, the statistical tests applied to identify significant results, and the economic interpretation of those results. Unfortunately, some damages studies fail to address all of these elements properly.

Attorneys obviously have an incentive to ensure that their economic experts do not misuse econometrics in the preparation of damages estimates. Yet, for those unfamiliar with the theory and practice of econometrics, there is a substantial leap from understanding a fundamental concept to being able to identify fatal shortcomings in an actual analysis. An examination of a few damages studies that failed to make the grade may provide a more concrete understanding of the significance and role of these elements. The following sections discuss the econometric work in two cases: *Conwood Co. v. U.S. Tobacco Co.*[1] and *In re Industrial Silicon Antitrust Litigation.*[2] The econometric analysis in each of these cases arguably suffered from at least one

1. 290 F.3d 768 (6th Cir. 2002), *cert. denied*, 537 U.S. 1148 (2003).
2. 1998-2 Trade Cas. (CCH) ¶ 72,348 (W.D. Pa. 1998).

fundamental error which, if corrected, would have affected the damages estimate dramatically. In one case the apparent error was not exposed at trial and a jury awarded substantial damages. In the other case, the issues were exposed at trial and the jury awarded no damages

B. *Conwood Co. v. U.S. Tobacco Co.*

In *Conwood Co. v. U.S. Tobacco Co.*,[3] Conwood, a manufacturer of moist snuff, alleged that the dominant firm in the moist snuff market, U.S. Tobacco, used illegal marketing practices that impeded the growth in market share of Conwood products. These practices included unauthorized removal of display racks for Conwood moist snuff products. After hearing an estimate of the damages from those practices from one of Conwood's expert witnesses, the jury found U.S. Tobacco liable and awarded Conwood $350 million. When trebled to $1.05 billion, the verdict was the largest antitrust damage award up to that time.

Conwood's expert asserted a foothold theory of damages. According to this theory, U.S. Tobacco's alleged illegal practices, which intensified after 1990, had a greater impact on the growth of Conwood's market share in states where Conwood initially had a small market share. The theory held that a larger market share created a foothold that would be less susceptible to the alleged illegal practices. The expert's theory relied largely on comments from Conwood personnel to the effect that U.S. Tobacco's bad acts disproportionately impacted states in which Conwood had a smaller market share.

As a test of his damage hypothesis, the expert performed regression analysis on a data set that included state-by-state market share data for Conwood products in 1984, 1990, and 1997. In his model, the expert used a constant term and the initial market share to explain the change in market share for each of two periods, 1984–90 and 1990–97.[4]

The very simple estimated equation was as follows:

$$\text{Change in Market Share} = \alpha + \beta * \text{Initial Market Share}$$

3. 290 F.3d 768 (6th Cir. 2002), *cert. denied*, 537 U.S.1148 (2003).
4. The data set included data for the District of Columbia, but not for Alaska or Hawaii. While the expert also estimated alternative regressions using additional values, his damage calculations used only Conwood's initial market share as an explanatory variable.

The expert used ordinary least squares analysis to estimate the constant term, α, and the coefficient for the impact of initial market share, β. The results for the 1984-90 period showed a small and slightly negative value for β which was not statistically significant.[5] The expert, therefore, concluded that there was no relationship between the initial market share and the subsequent market share growth in the 1984-90 period, which preceded U.S. Tobacco's alleged illegal practices (the "before period"). The results for the 1990-97 period (the period after the practices had intensified) demonstrated a statistically significant and positive relationship between the initial market share and the subsequent market share growth. Contrasting this finding with the results for the before period, the expert concluded that a change occurred after 1990 in the relationship between the initial market share and the subsequent market share growth.[6] His explanation for this change was that the intensification of U.S. Tobacco's alleged illegal practices suppressed Conwood's growth in small market share states, but not in states with larger market shares where Conwood had established a foothold. Thus, the larger the initial market share, the greater Conwood's growth. The district court admitted the expert's analysis, and the Sixth Circuit upheld the admission of the testimony on appeal.

A critical part of damage model estimation and testing is showing that the results do not substantively change with reasonable alternative choices of specification or of data used to estimate the model. In other words, the results must be robust. A result which is not robust can in some ways be worse than no result at all, for it has a high potential to be misleading. In this case, the exclusion of a single data point may have

5. The regression approach provides a standard deviation (alternatively, a standard error) for the estimate which allows one to determine the likelihood that the true value is, in fact, different from zero. Analysts typically want the likelihood of getting a particular estimate, if the true value were actually zero, to be less than 5% before concluding that a result is statistically significant.
6. This is a testable hypothesis. The estimate of β in each period has an associated standard deviation that measures the precision of the estimate. The standard deviations and the estimated values of the two estimates can be used in a statistical test to determine if the difference in the estimated values is statistically significant. This test was not reported to have been performed by the expert. Had it been performed, the outcome might have been significantly different.

completely changed the expert's results and conclusion The District of Columbia represented, by far, the smallest market for moist snuff in each of the years 1984, 1990, and 1997, ranging from one one-thousandth of a percent of total moist snuff sold in the United States in 1984 to three one-hundredths of a percent of total moist snuff sold in the United States in 1997.[7] Consequently, relatively small changes in the amount of moist snuff sold by Conwood in the District of Columbia—caused, for example, by decisions of a few stores to stock or drop Conwood's product—could easily translate into large changes in its D.C. market share. It is, therefore, not surprising that in the District of Columbia there was a far greater variance across years in the change in Conwood's market share than in any other state. The unique behavior of Conwood's D.C. market share relative to that of other markets considered can be seen in Figure 1. The D.C. market share declines dramatically from 21.0 percent in 1984 to 7.2 percent in 1990, followed by a similarly dramatic increase from 7.2 percent in 1990 to 17.6 percent in 1997. The market shares for the other 48 markets generally increase and exhibit reasonably consistent behavior. The actual values for market share and change in market share are shown in Figure 2, along with the relationship predicted by the expert's regression. Figure 2 shows that the D.C. data point is a substantial distance from the others and from the predicted line. An outlier such as this can have a great impact on the regression result.[8]

7. These figures are based on the expert's data, which exclude Alaska and Hawaii. The pounds of moist snuff sold in the District of Columbia ranged from 3,617 pounds in 1984 out of a total market of 36.5 million pounds to 17,219 pounds in 1997 out of a total market of 53.1 million pounds.
8. Influence statistics show that the D.C. data point has the greatest influence on the regression results of any of the 49 markets included in the expert's regression.

Figure 1
The Pattern of Change in Conwood's D.C. Market Share Differs Significantly from that in Other Markets

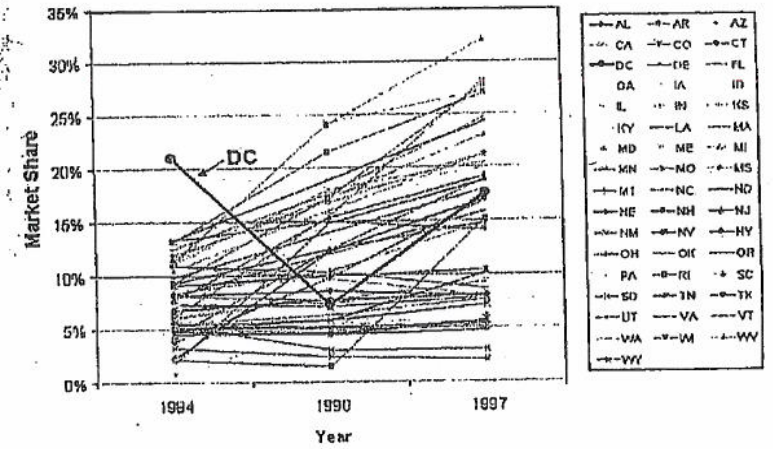
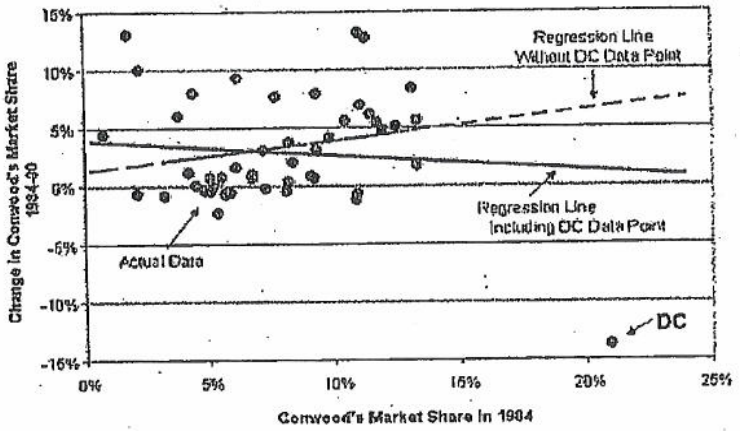


Figure 2
Regression of Change in Conwood's Market Share from 1984-1990, With and Without District of Columbia Data Point



If the model in this case were robust and reliably represented the behavior of the entire market, then dropping the observation for the District of Columbia from the analysis would make little substantive difference. However, the results change completely with the exclusion of the D.C. data point. Without the D.C. data point, the coefficient on initial market share in the before period increases substantially from 0.13 to 0.26. The coefficient on initial market share in the after period changes only slightly from 0.22 to 0.24. The 0.26 coefficient in the before period exceeds, but is statistically indistinguishable from, the 0.24 coefficient in the after period.[9] Therefore, excluding just the D.C. data point would have changed the regression results completely and the expert would have had no basis from the regression results to conclude that the relationship between initial market share and subsequent market share growth had changed between the before and after periods. Without that conclusion, the expert would have had no econometric support for his foothold theory and no econometric indication of damages.

The identification of the D.C. data point as an outlier could have been achieved easily through visual inspection of data plots such as those shown in Figures 1 and 2. More sophisticated statistical approaches, such as the use of influence statistics, would have achieved the same end, but should not have been necessary. The failure of the plaintiff's expert to investigate the data allowed him to conclude that significant damages had been experienced—although lay testimony offered at trial may have allowed the jury to arrive at a similar result without reference to the expert's work. The failure of the defendant's expert to investigate the same data allowed the expert's conclusion to survive without challenge. Examination of the data is one of the most basic elements of any analysis, yet in this case the failure to identify a single egregious outlier may have contributed significantly to a billion-dollar judgment.[10]

9. The statistical test to determine whether the entire relationship (coefficients on both the intercept and initial market share) had changed would also find no statistically significant difference.

10. Subsequent to the trial, Daniel McFadden, who was not an expert witness at the trial, submitted an *amicus* brief in the Sixth Circuit concerning whether the testimony of the plaintiff's damage expert should have been excluded under the criteria set forth in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993). When the Sixth Circuit affirmed the district court's admission of the testimony, Professor McFadden and a number of other statistical-econometric experts also submitted an *amicus* brief to the U.S. Supreme Court in support of a petition for certiorari, which was denied.

11. 1998-2 Trade Cas. (CCH) ¶ 72,348 (W.D. Pa. 1998).

12. These price movements occurred prior to any known meetings between the defendants but after the complaint alleged a conspiracy could have begun.

C. *In re Industrial Silicon Antitrust Litigation*

In re Industrial Silicon Antitrust Litigation[11] involved allegations of price fixing in industrial grade silicon and ferrosilicon metal in the 1980s and early 1990s. Following a criminal investigation by the Department of Justice, three producers were charged with violating Section 1 of the Sherman Act. By 1996, two producers had signed plea agreements and the third was later found guilty at a criminal trial. Subsequently a class and several opt-out groups brought civil actions against the three companies and additional parties. All but two of the defendants, Globe Metallurgical and American Alloys, settled with before trial. In the cases that went to trial, the jury found that the plaintiffs had not suffered any injury.

The expert for the class identified what he called "anomalous" price movements in the 1988-89 time frame and performed a price-cost margin analysis.[12] The expert's analysis assumed that, but for the conspiracy, the ratios of product prices to production costs should have been similar during the anomalous price period and the earlier baseline period. The expert reasoned that any evidence of larger margins during the anomalous price period was consistent with price fixing. Indeed, the analysis produced $24 million in estimated damages as a result of the alleged higher prices for silicon and ferrosilicon metals. However, the expert conceded that the margin analysis did not control for market factors that might influence product prices and margins. The expert conducted a regression analysis to determine the implications of this omission.

The regression analysis performed by the expert seemed straightforward and reasonable. He selected a precollusion baseline

period from 1980-87 and estimated an equation using supply, demand, and other factors to explain ferrosilicon metal prices:[13]

> Ferrosilicon metal prices = function (supply factors, demand factors, other factors)

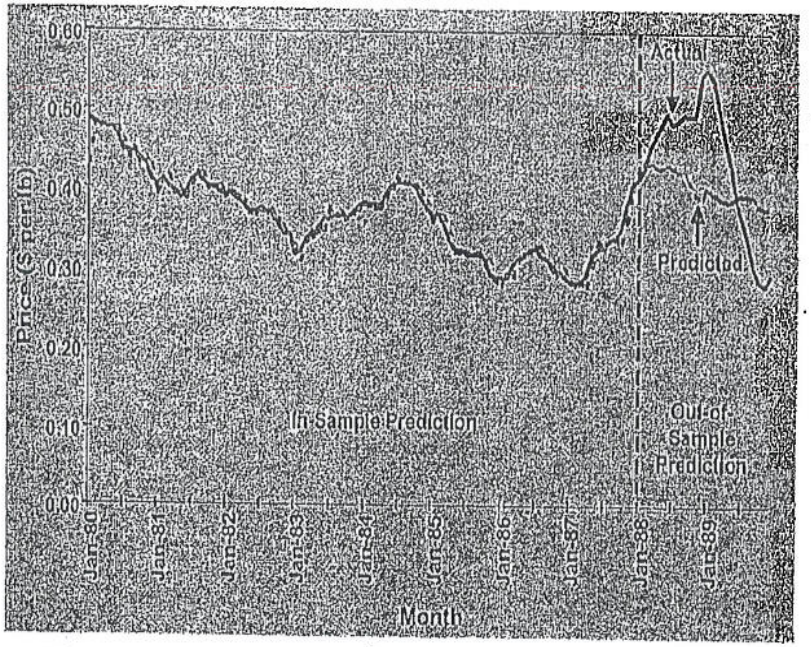
Factors for domestic demand included steel industry production and ferrosilicon imports. Supply factors included input costs as measured by producer price indices for electricity, scrap metal, coal, and labor. Additionally, the expert included inventories as a proxy for capacity utilization, and the number of domestic producers as a proxy for competition.

The expert also checked his results for some of the fundamental problems that occur in regression analysis. One basic test is for autocorrelation, which occurs when the residuals (the difference between actual and fitted values) in different periods are statistically related to each other. He found that residuals for any period were strongly related to residuals in the preceding two periods. This type of error may indicate a deficiency that causes the model to systematically forecast high or low for long periods of time. However, the expert attempted to correct this problem by estimating a second-order autoregressive-error model. Among other things, this correction uses prices in the preceding two periods to predict the current period price.

Parameter estimates from the expert's regression analysis for 1980 to 1987 were used to predict but-for prices in the 1988-89 alleged damage period. Figure 3 shows the fitted and actual prices by month from 1980-87, and the predicted and actual prices from 1988-89. Based on the close fit of predicted prices to actual prices from 1980-87, the expert concluded that the model was doing a reliable job of explaining price movements and could be used to forecast accurately what prices in other periods should be absent collusion. Consequently, he concluded that the significant divergence between actual prices and the out-of-sample predicted prices from 1988-89 must have resulted from the successful collusive activities of the defendants rather than from other economic factors.

13. The expert conducted his analysis on silicon metal and 50% and 75% ferrosilicon metals separately. However, the approach, findings, and conclusions for each of these metals were similar, so for simplicity the discussion is restricted to ferrosilicon metal only.

Figure 3
Actual and Predicted Prices for Ferrosilicon Metal, 1980-1987 Regression Sample



The case demonstrates that models that fit data well may not predict well. The conclusion that prices departed from but-for levels hinges critically on the belief that this model can accurately forecast prices in the absence of collusion. The expert assumed, but arguably did not establish, that this was the case. If the model were reliable and there was an impact from collusion, then two results would be expected: (1) the model, if estimated over the entire non-collusive and collusive period, should not fit well during the collusive period, and (2) the model, if estimated during a sub-period of the non-collusive period, should be able to accurately predict prices in the rest of the non-collusive period.

Figure 4 shows the results obtained by estimating the model used to fit the "non-collusive" period over the entire period from 1980 to 1989. The results indicate that the model fits the actual data for the collusive period very well, providing no indication of a departure from market conditions in the preceding period.

The results when the expert's model was estimated from 1980 through mid-1984 and used to predict prices from mid-1984 through 1987 are shown in Figure 5. The graph contains the in-sample fit from 1980 through mid-1984, as well as the predictions for the non-collusive period from mid-1984 through 1987. The results show that the model might not be capable of producing accurate ferrosilicon price predictions within the non-collusive period.

Figure 4
Actual and Predicted Prices Using Sample from Entire Period

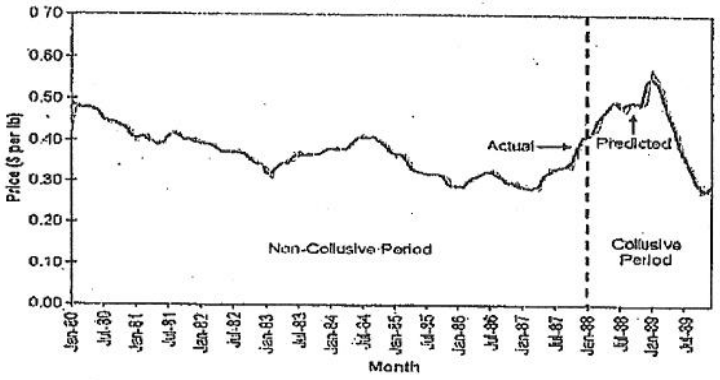
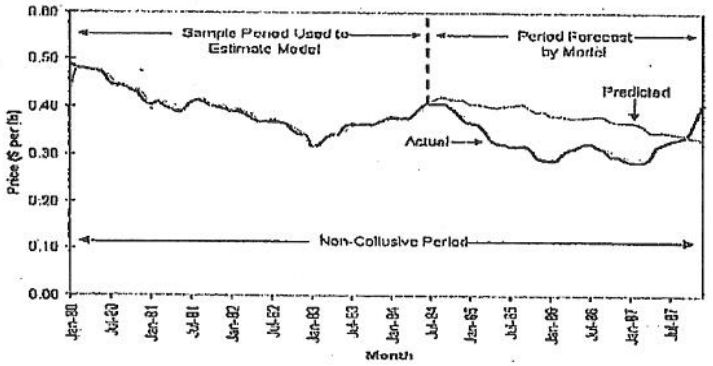


Figure 5
Actual and Predicted Prices Using Sample from 1980 to mid-1984



This particular model, therefore, appears capable of fitting prices but not predicting prices. The primary reason for this is the autoregressive

structure of the model, which in the case of this model means that current values are only explained by immediately preceding values and not from the variables representing supply and demand factors.[14] Therefore, within the sample the fitted values track changes to new price levels with a short lag and generally track price movements very well. However, outside of the sample, forecasts from this type of model will gradually approach an equilibrium level that may be a very poor predictor of actual prices. The expert may have failed to recognize, as shown by Figures 4 and 5, that this type of model will lead to poor out-of-sample predictions but excellent within-sample fit.

This example indicates the importance of checking the in-sample and out-of-sample properties of a model. Had the expert tested his model's in-sample predictive ability and out-of-sample fitting ability, he might have questioned whether there was any statistical basis for concluding that ferrosilicon prices in the collusive 1988 and 1989 period behaved differently from those in the preceding non-collusive period.

D. Conclusion

Econometrics is a powerful and often essential tool in considering economic liability and measuring damages. However, apparently sophisticated econometric analyses can be invalidated due to the failure to consider basic analytic issues. While one would hope that these occurrences would be rare among practitioners of econometrics in the litigation arena, there is considerable reason to believe that they are not. The examples discussed here demonstrate that damages estimates in the tens or hundreds of millions of dollars can hinge critically on such fundamental activities as checking for outliers, designing a proper experiment, or checking the properties of a model. These are problems that can be explained to a jury or a judge. The failure to catch these

14. In this model, current ferrosilicon prices are primarily explained by the prices in the previous two months. When a variant of the model that omits the other explanatory variables altogether is estimated, the in-sample fit is basically unchanged. In other words, lagged prices account for almost all the explanatory power of this model.

problems before putting forth an affirmative damages estimate can be fatal. The failure to expose these problems in rebuttal can be enormously costly.

The fact that studies are often undermined by the failure to carry out fundamental analytical steps means that attorneys should never delegate totally the analytical responsibility to their experts. Attorneys need to make an investment to understand the basic elements of a proper econometric analysis to be in a position to challenge their own experts to ensure that obvious problems have not been overlooked. A small investment of time can pay big dividends for the attorney, the expert, and the client.

CHAPTER VIII

THE USE OF ECONOMETRICS IN CLASS CERTIFICATION

A. Introduction

Econometric analysis can be useful to help satisfy certain of the requirements of Rule 23 of the Federal Rules of Civil Procedure, which governs class certification.[1] In particular, because econometric analysis allows one to control for hundreds of individual variables, it can be used to defeat the argument that individual issues predominate, which relates directly to Rule 23(b)(3). As a practical matter, a proper regression analysis may allow a court to certify a class that would otherwise appear not to meet the requirements of Rule 23(b)(3). For instance, in two similar cases involving the sale of cattle, a class was certified where

1. Rule 23 imposes a number of different requirements on a potential class. Rule 23(a) requires a class to demonstrate numerosity, commonality, typicality, and adequacy of representation. Rule 23(b) requres that the proposed class action meet at least one of the following criteria:

> (1) the prosecution of separate actions by or against individual members of the class would create a risk of:
>
> (A) inconsistent or varying adjudications with respect to individual members of the class which would establish incompatible standards of conduct for the party opposing the class or;
>
> (B) adjudication with respect to individual members of the class which would as a practical matter be dispositive of the interests of the other members not parties to the adjudications or substantially impair their ability to protect their interests; or
>
> (2) the party opposing the class has acted or refused to act on grounds generally applicable to the class, thereby making appropriate final injunctive relief or corresponding declaratory relief with respect to the class as a whole; or
>
> (3) the court finds that the questions of law or fact common to the members of the class predominate over any questions affecting only individual members, and that a class action is superior to other available methods for the fair and efficient adjudication of the controversy.

FED. R. CIV. P. 23(b).